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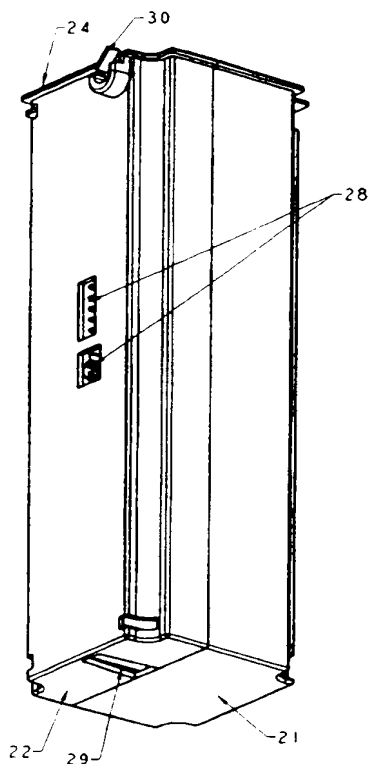
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[Continued on next page]

(54) Title: **ROTARY ACTUATOR, ESPECIALLY FOR BUILDING-IN ADJUSTABLE FURNITURE, SEPARATE BED BOTTOMS AND BEDS**



(57) Abstract: A rotary actuator, preferably for incorporation in articles of furniture, separate mattress supports and beds, said actuator comprising an electric motor with a power supply and a control unit. Via a transmission, the electric motor drives a rotatable arm intended to be secured to a movable part in a structure in which the actuator is incorporated, as well as a fixed arm intended to be secured to a stationary part of the structure. The electric motor with associated transmission is mounted in a tube (10), preferably of quadrangular cross-section. The tube is also utilized for the incorporation of the power supply and the control unit. In an embodiment, the power supply and the control unit are incorporated in a cabinet (20) intended to be inserted into the hollow space of the tube, as the external cross-section of the tube fits the internal cross-section of the tube, and the cabinet has an end member with a protruding edge intended to be engaged with the end of the tube. This avoids an external, expensive cabinet as well as adaptation and configuration of suspensions in the structure in which the actuator is to be incorporated. Also, space is saved, just as sealing against moisture and water is facilitated.

WO 01/17399 A1

**Rotary Actuator, especially for Building-In adjustable Furniture, seperate Bed Bottoms and Beds**

5 The present invention relates to a rotary actuator, preferably for incorporation in articles of furniture, separate mattress supports and beds, said actuator comprising an electric motor with a power supply and a control unit, wherein the electric motor, via a  
10 transmission, drives a rotatable mounting bracket, preferably shaped as an arm intended to be secured to a movable part, in a structure in which the actuator is incorporated, as well as a fixed mounting bracket, likewise preferably shaped as an arm intended to be  
15 secured to a stationary part of the structure, and wherein the electric motor with associated transmission is mounted in a tube, preferably of quadrangular cross-section.

20 Rotary actuators of this type may be used for performing movements and positional adjustments in articles of furniture, including beds and separate mattress supports, care beds, hospital beds, nursing equipment, seats for vehicles, machinery and within the industry. German  
25 Utility Model DE 298 02 384 U1 discloses a mattress support with incorporated rotary actuators for adjusting the backrest part or the legrest part.

From an overall point of view it is desired that the rotary actuator should be driven by a low volt motor, typically a 24 volts DC motor. The power supply is based on a  
30 transformer for connection to the mains or on a rechargeable battery pack. This takes up space, and so does the control of the actuator, and the space available is al-

ready rather limited as it is. Typically, two to four actuators are incorporated in a sitting posture or lying posture article of furniture.

5 It is required in some connections that the rotary actuator with associated electronic equipment is moisture- or water-tight. This applies to e.g. hospital beds which are washed at regular intervals in washing machines intended for the purpose.

10

By constructing the rotary actuator as stated in claim 1 with the power supply mounted in the tube, space is saved, while avoiding adaptation and construction of suspensions for a separate electronics box in the structure  
15 in which the actuator is to be incorporated. Moreover, it is easy to make the structure moisture- or water-tight. The presence of a battery pack reduces the risk of formation of oxyhydrogen gas, since the volume in the tube is typically larger than in a separate electronics box,  
20 which is small in size.

In an embodiment, the power supply and the control unit are incorporated in a cabinet intended to be inserted into the hollow space of the tube. It will be appreciated  
25 that such a cabinet, unlike a separate electronics box, does not have to satisfy special requirements in terms of strength, and it may be manufactured with a thin wall thickness and of simple plastics material. As the external cross-section of the cabinet fits the internal cross-  
30 section of the tube, it is thereby retained, and separate retention measures are avoided. It is essential out of regard for the user that the cabinet does not clatter in the tube. When the cabinet has an end member with a protruding edge intended to be engaged with the end of the

tube, good possibilities of moisture and water tightness are achieved. The edge may be formed with a groove for sealing and receiving the end of the tube.

5 The invention will be explained more fully below with reference to the embodiment illustrated in the accompanying drawing. In the drawing:

Fig. 1 shows a mattress support intended to be placed or  
10 incorporated in a bed,

fig. 2 shows a rotary actuator in its entirety,

fig. 3 shows a cabinet for power supply and control electronics (not shown),  
15

fig. 4 shows the end of the cabinet seen from the left in fig. 3,

20 fig. 5 shows a longitudinal section through the cabinet,

fig. 6 shows a cross-section along the line VI-VI in fig. 5, and

25 fig. 7 shows a cross-section along the line VII-VII in fig. 5.

The mattress support shown in fig. 1 comprises an outer frame 1 which includes a mattress support portion consisting of a pivotable backrest part 2, a fixed central part 3, and a legrest part 4 which is articulated. The central part 3 is secured to the sides of the outer frame 1.  
30

The backrest part 2 is pivotable about a shaft 5 likewise secured at the sides of the outer frame 1, and correspondingly the legrest part is pivotable about a shaft 6. Both the backrest part 2 and the legrest part 3 perform their movements with a rotary actuator 7, as shown in fig. 2. The rotary actuator comprises a tube 10 of quadrangular cross-section that accommodates an electric motor which is connected with an arm 11 via a transmission. An arm 12 is secured to each end of the tube 10. At the backrest part 2, the arm is equipped with a wheel 13 which is guided in a guide rail 14 secured to the backrest part. The tube 10 is rotatably mounted about its longitudinal axis in a bracket 15 secured at each side of the outer frame 1. As the other arm 11 of the actuator is fixed, the tube 10 and the arms 12 secured on the end thereof will rotate when the actuator is activated. The arms 12 will thereby raise or lower the backrest part, as this will pivot about its shaft 5. The legrest part is raised and lowered in a corresponding manner, as the ends of the arms 12a on the actuator 7a of the legrest part are rotatably secured to a bracket on the outermost link 4a of the legrest part. Activation of the actuator will cause the legrest part 4 to be raised or lowered, as the arm 12a will cause the innermost link 4b to rotate about the shaft 6 through a raising and rotating movement of the outermost link 4a of the legrest part.

A cabinet 20 is inserted at the other end of the tube 10 opposite the motor and the transmission, as shown in fig. 3. The cabinet has a substantially quadrangular cross-section which fits the internal cross-section of the tube, so that the cabinet may be pushed into it. As will appear, the longitudinal corners 31 of the cabinet are concave inter alia to accommodate screw ducts and irregu-

larities, if any, in the corner regions of the tube 10. As will appear, the cabinet consists of a base part 21 and a cover 22 which may be secured to each other by snap locks 23. The external side of the cabinet has an annular edge 24 intended to be engaged with the end of the tube 10. The cabinet is secured by the arm 12 which is arranged externally on the end of it.

Internally, the cabinet is divided into two chambers, viz. a chamber 25 for a transformer and a chamber 26 for a printed circuit board with the control electronics. The last-mentioned chamber is formed with grooves 27 for receiving the printed circuit board with the control.

Connectors 28 are provided at the top of the cabinet inter alia for the connection of a remote control and also for connecting the control and the power supply to a rotary actuator at the other end of the mattress support. These connectors are accessible via holes 28a in the upper side of the tube. Further, at the end seated in the tube, the cover has a connector 29 for connecting the power supply and the control to the motor at the other end of the tube. For mounting purposes, the cable has an excessive length relative to the tube. At one corner at the external end of the cabinet, it is formed with an inlet 30 for a cable for connection to the mains. The end of the tube 10 has a hole for the cable inlet. Moisture- or water-tight connectors and bushings are used of course in a moisture- or water-tight version.

30

It will be appreciated that the invention may be realized in other connections than beds or mattress supports, and it will also be appreciated that the invention may be implemented in various configurations. For example, nothing

prevents the cabinet from being divided into two separate cabinets, one for the transformer and one for the electronics. In principle, the cabinet might also be a tube.

P a t e n t   C l a i m s :  
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1. A rotary actuator, preferably for incorporation in  
5 articles of furniture, separate mattress supports and  
beds, said actuator (7) comprising an electric motor with  
a power supply and a control unit, wherein the electric  
motor, via a transmission, drives a rotatable mounting  
10 bracket, preferably shaped as an arm (11) intended to be  
secured to a movable part (2), in a structure in which  
the actuator is incorporated, as well as a fixed mounting  
bracket, likewise preferably shaped as an arm (12) in-  
tended to be secured to a stationary part of the struc-  
15 ture, and wherein the electric motor with associated  
transmission is mounted in a tube (10), preferably of  
quadrangular cross-section, c h a r a c t e r i z e d in  
that the power supply and the control unit are likewise  
mounted in the tube (10).
- 20 2. A rotary actuator according to claim 1, c h a r a c -  
t e r i z e d in that the power supply and the control  
unit are incorporated in a cabinet (20) intended to be  
inserted into the hollow space of the tube (10).
- 25 3. A rotary actuator according to claim 2, c h a r a c -  
t e r i z e d in that the external cross-section of the  
cabinet fits the internal cross-section of the tube.
4. A rotary actuator according to claim 2 or 3,  
30 c h a r a c t e r i z e d in that the cabinet has an end  
member with a protruding edge (24) intended to be engaged  
with the end of the tube (10).
5. A rotary actuator according to claim 4, c h a r a c -



ter i z e d in that the protruding edge (24) is formed with a groove for sealing and receiving the end of the tube (10).

5 6. A rotary actuator according to claim 1, c h a r a c -  
t e r i z e d in that holes (28a) are provided in the tube for access to connectors arranged on the outer side of the cabinet.

10 7. A rotary actuator according to claim 1, c h a r a c -  
t e r i z e d in that the motor and the cabinet are interconnected by a wire extending within the tube, and that one end of the wire has a plug which fits a corresponding connector (29) in the cabinet, preferably arranged at the end which is located farthest inside the  
15 tube after mounting.

8. A rotary actuator according to claim 2, c h a r a c -  
t e r i z e d in that the cabinet (20) has an overall  
20 quadrangular, preferably square cross-section with inwardly concave longitudinal corner regions (31).

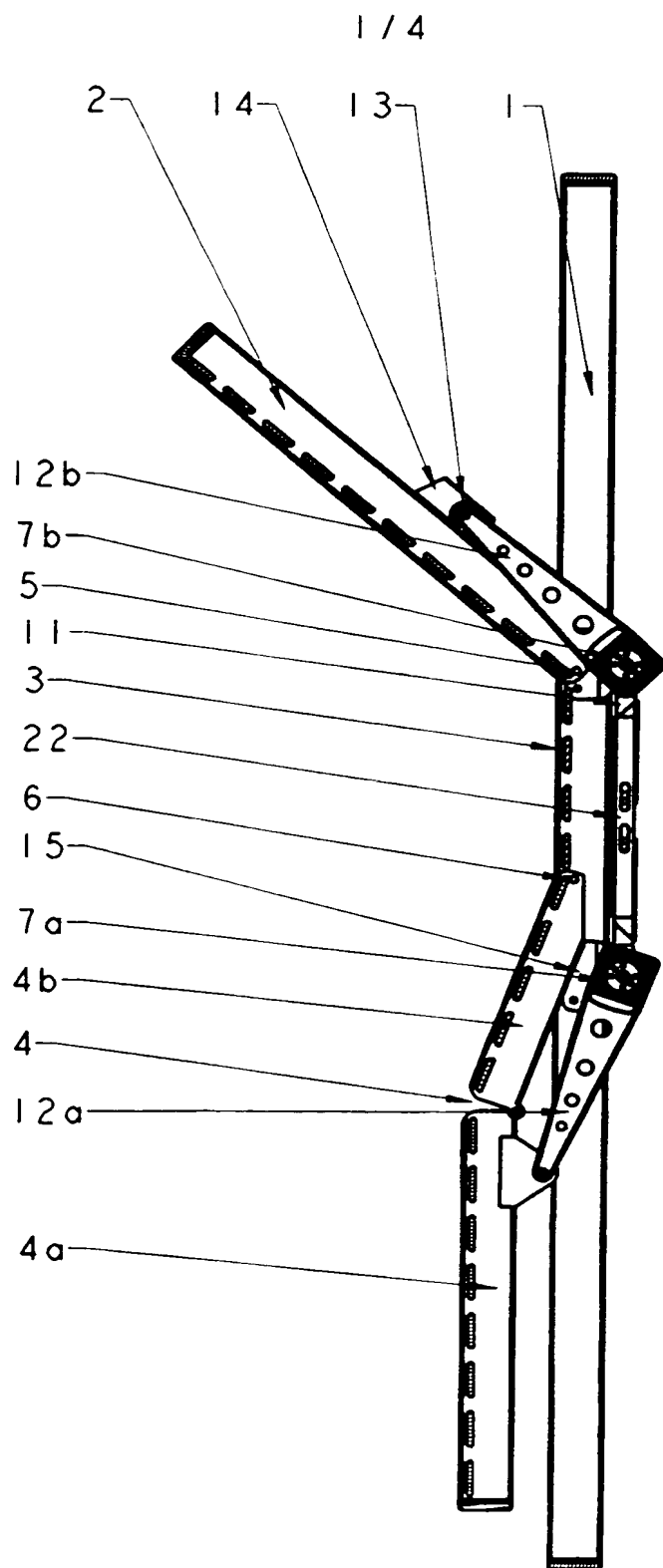


Fig. 1

2 / 4

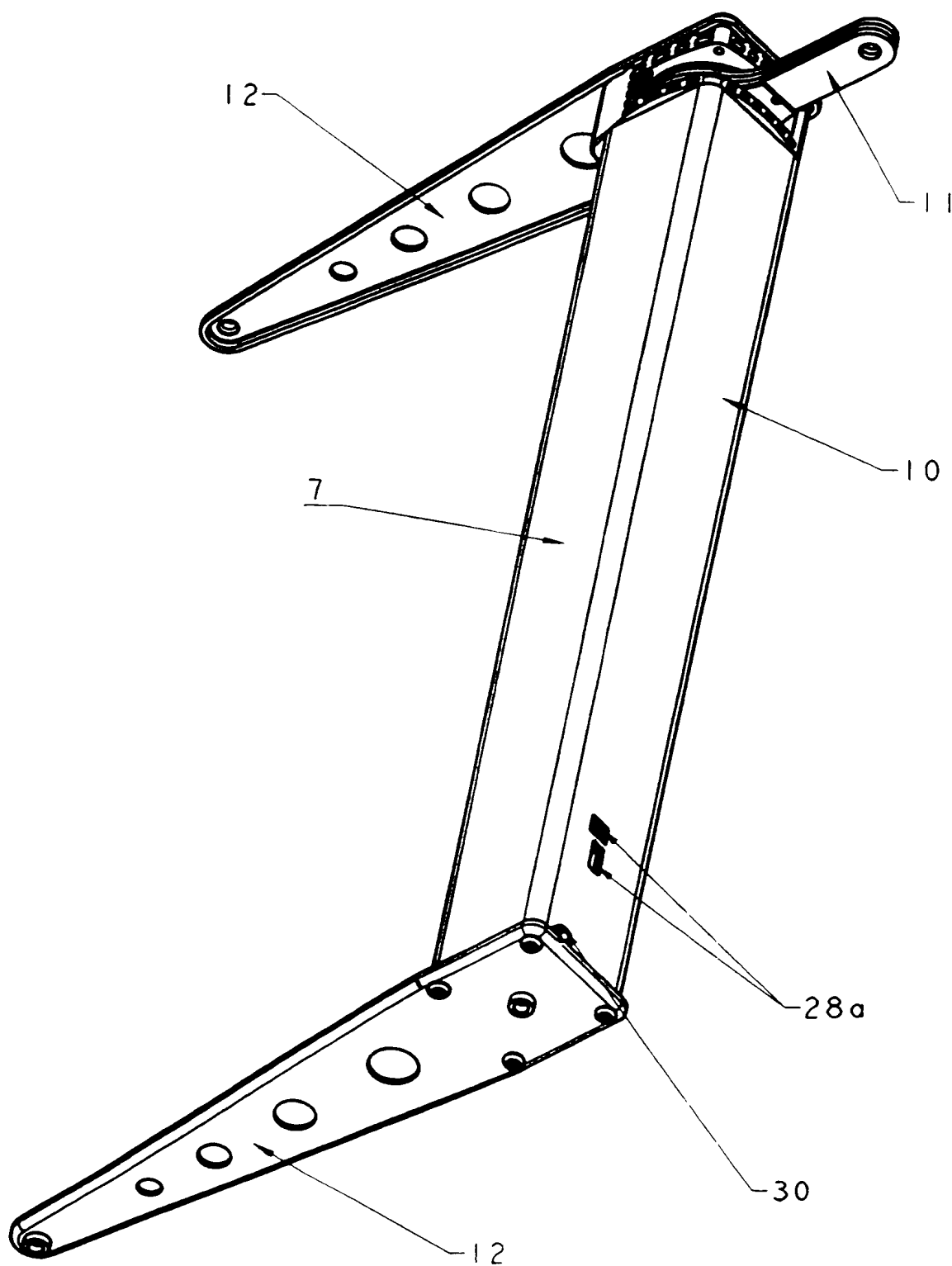


Fig. 2

3 / 4

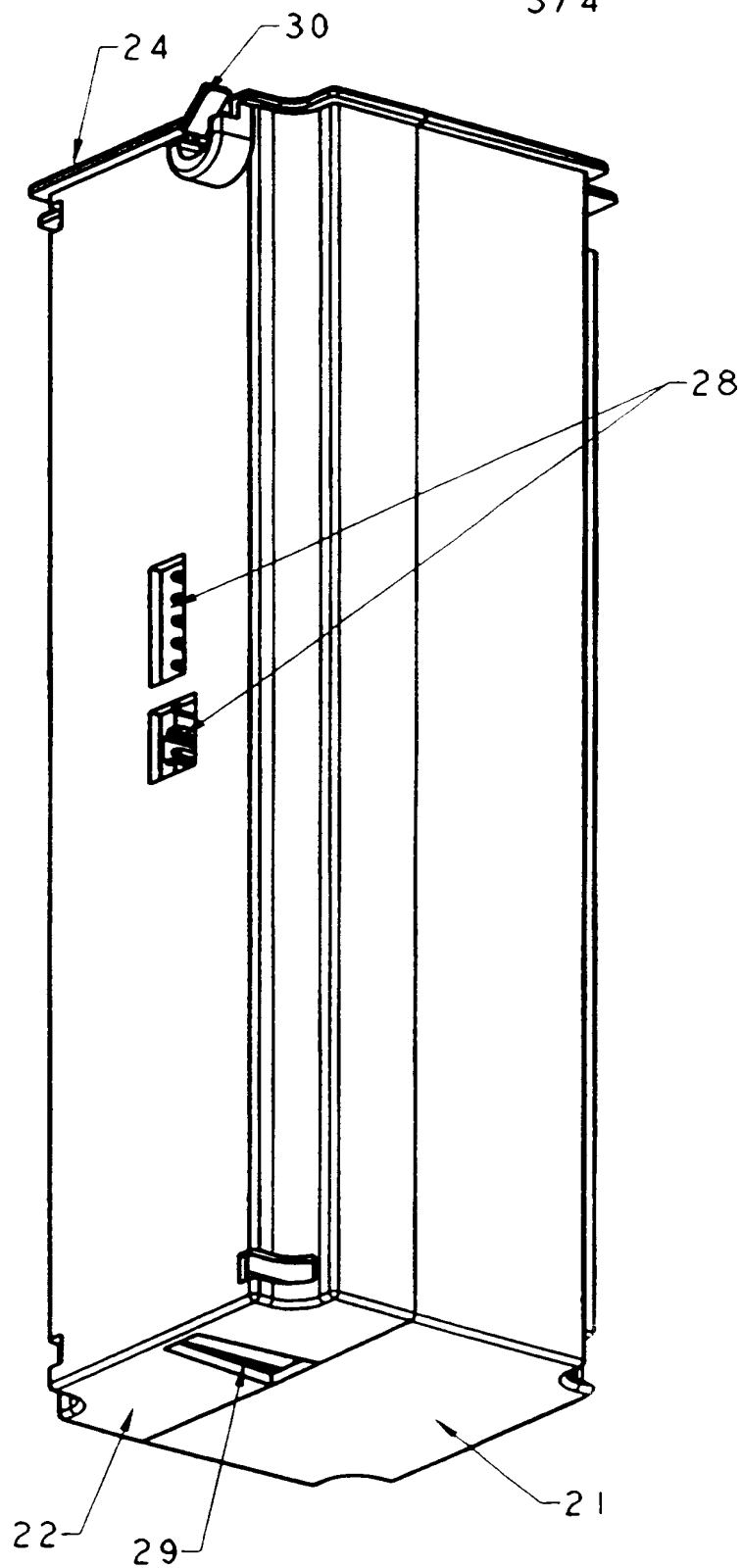


Fig. 3

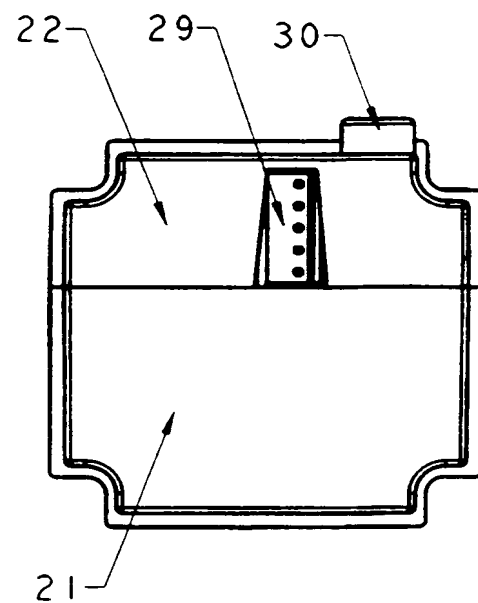


Fig. 4

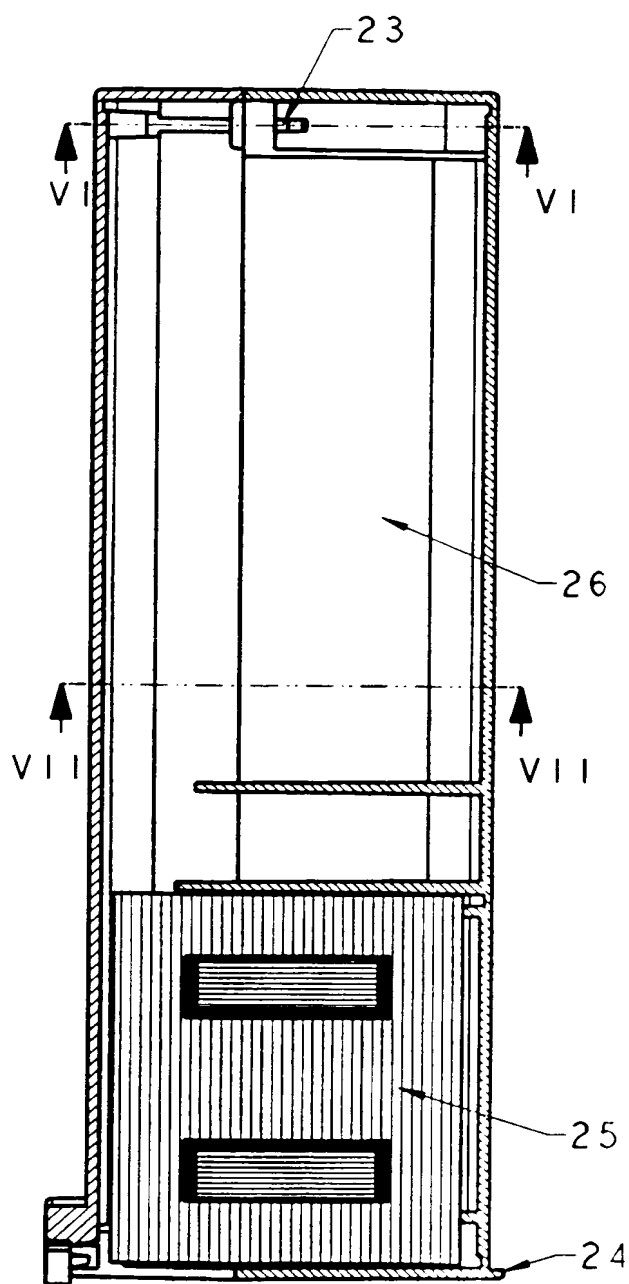
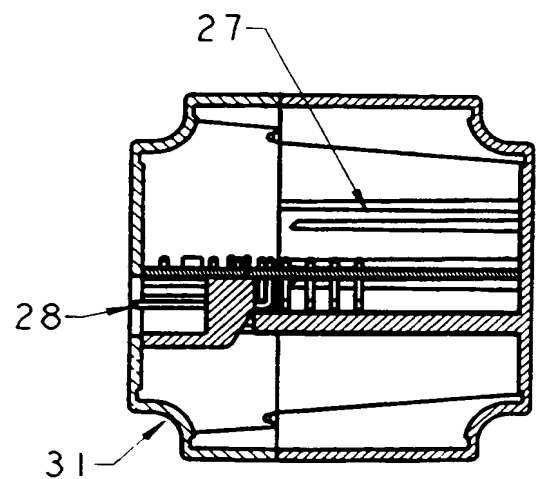
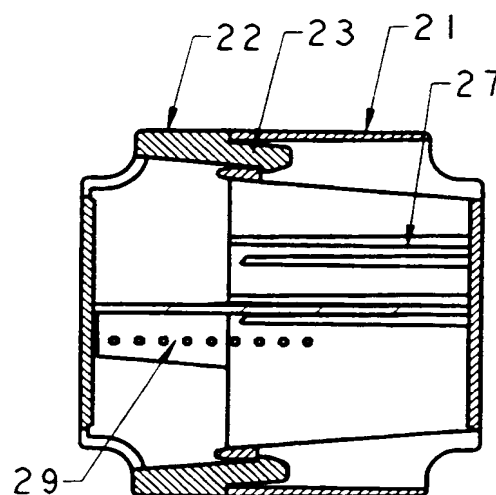


Fig. 5



SECTION VII - VII

Fig. 7



SECTION VI - VI

Fig. 6

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK 00/00482

| A. CLASSIFICATION OF SUBJECT MATTER   |  |  |
|---|--|--|
| IPC7: A47C 20/18<br>According to International Patent Classification (IPC) or to both national classification and IPC   |  |  |
| B. FIELDS SEARCHED  |  |  |
| Minimum documentation searched (classification system followed by classification symbols)   |  |  |
| IPC7: A47C  |  |  |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched   |  |  |
| SE,DK,FI,NO classes as above  |  |  |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  |  |  |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT  |  |  |
| Category*   | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No.  |
| A   | US 5544375 A (URNESS ET AL), 13 August 1996<br>(13.08.96), see whole document      | 1-8  |
| A   | EP 0568957 A1 (VG S.A.), 10 November 1993<br>(10.11.93), see whole document        | 1-8  |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.  |  |  |
| <p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"Z" document member of the same patent family</p> |  |  |
| Date of the actual completion of the international search   |  | Date of mailing of the international search report                               |
| 7 December 2000   |  | 12 -12- 2000   |
| Name and mailing address of the ISA /<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86   |  | Authorized officer<br><br>Sven-Erik Bergdahl/MN<br>Telephone No. +46 8 782 25 00 |

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/DK 00/00482**

| Patent document<br>cited in search report |         |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---------|----|---------------------|----------------------------|---------------------|
| US  | 5544375 | A  | 13/08/96            | US 5685035 A               | 11/11/97            |
| EP  | 0568957 | A1 | 10/11/96            | NONE                       |                     |